AMENDMENTS TO THE CLAIMS

Claim 1 (Currently Amended): A multilayer thin film formed on ~~an~~ a Si substrate by epitaxial growth, the multilayer thin film comprising:

a buffer layer formed on said Si substrate, where said buffer layer includes

an oxide thin film of zirconium or of a rare earth element on said Si substrate;

~~a first perovskite oxide thin film on said oxide thin film;~~ and

an electrically conductive thin film having (100) or (001) orientation on said ~~first perovskite~~ oxide thin film,

a ~~second~~ perovskite oxide thin film formed on said buffer layer, which is grown epitaxially with respect to said buffer layer, ~~where said second perovskite oxide thin film comprises $PbTiO_3$ and has a (100) or (001) orientation,~~ and

a ferroelectric thin film having (100) and (001) orientation, which has a different composition than ~~the second~~ said perovskite oxide thin film and which is epitaxially grown on said ~~second~~ perovskite oxide thin film.

Claim 2 (Previously Presented): The multilayer thin film of claim 1, wherein said second perovskite oxide thin film has insulating properties.

Claims 3-4 (Canceled)

Claim 5 (Previously Presented): The multilayer thin film of claim 1, wherein said ferroelectric thin film comprises PZT.

Claim 6 (Original): An electron device comprising a multilayer thin film as recited in claim 1.

Claim 7 (Previously Presented): A process for preparing the multilayer thin film of claim 1, comprising:

forming a buffer layer including an oxide thin film of zirconium or of a rare earth element on an Si (100) substrate,

epitaxially growing a perovskite oxide thin film having a (100) or (001) orientation on said buffer layer, and

epitaxially growing a ferroelectric thin film on said perovskite oxide thin film.

Claim 8 (Previously Presented): The multilayer thin film of claim 1, wherein said buffer layer comprises ZrO_2.

Claim 9 (Previously Presented): The multilayer thin film of claim 1, wherein said buffer layer comprises Y_2O_3.

SUPPORT FOR THE AMENDMENT

This Amendment amends Claim 1. Support for the amendments is found in the specification and claims as originally filed. In particular, support for Claim 1 is found in the specification at least at page 13, lines 31-33 ("However, this ferroelectric thin film may have a 90° domain structure comprising (100) oriented crystals ***and*** (001) oriented crystals ..."). No new matter would be introduced by entry of these amendments.

Upon entry of these amendments, Claims 1-2 and 5-9 will be pending in this application. Claim 1 is independent.

REQUEST FOR RECONSIDERATION

Applicants respectfully request entry of the foregoing and reexamination and reconsideration of the application, as amended, in light of the remarks that follow.

The present invention provides a multilayer thin film including a ferroelectric thin film having improved properties as a result of being epitaxially grown on a primer layer of a perovskite oxide thin film that is grown on a buffer layer on a silicon substrate. See, e.g., specification at page 4, lines 13-16 and 25-30; page 5, lines 18-19. The specification at Example 1 shows that ferroelectric PZT grown on a primer layer of the perovskite oxide $PbTiO_3$ that is grown on a buffer layer ($Pt/Y_2O_3/ZrO_2$) on Si has an electromechanical coupling factor of $k^2 = 39\%$, while PZT grown directly on the buffer layer on Si without the primer layer of $PbTiO_3$ has an electromechanical coupling factor of only 33%, which is inferior to that obtained with the primer layer of $PbTiO_3$. See, specification at page 24, lines 6-24.

Claims 1-2 and 5-8 are rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 5,801,105 ("Yano-105") in view of U.S. Patent No. 5,674,563 ("Tarui"). In addition, Claims 1-2 and 5-8 are rejected under 35 U.S.C. § 103(a) over JP 10-017394 (where U.S. Patent No.

6,121,647 ("Yano-647") is used as an accurate translation of JP 10-017394) in view of Tarui. Claim 9 is rejected under 35 U.S.C. § 103(a) over Yano-105 or JP 10-017394 (where Yano-647 is used as an accurate translation of JP 10-017394) in view of Tarui, and further in view of U.S. Patent No. 5,744,374 ("Moon") or U.S. Patent No. 5,834,803 ("Nashimoto").

Yano-105 and Yano-647 disclose multilayers of a ferroelectric film grown directly on a buffer layer of $Pt/BaTiO_3/ZrO_2$ on a Si substrate.

In particular, Yano-105 discloses the structure: $BaTiO_3(001)$ / Pt(001) / $BaTiO_3(001)$ / $ZrO_2(001)$ / Si , and that $BaTiO_3$ is ferroelectric. Yano-105 at column 28, lines 54-55; column 2, lines 37-38.

Yano-647 discloses the structure: epitaxial ferroelectric film / Pt(001) / $BaTiO_3(001)$/ $ZrO_2(001)$ / Si. Yano-647 at column 7, lines 8-48; column 26, lines 42-47.

However, Yano-105 and Yano-647 fail to suggest the independent Claim 1 limitation of "the multilayer thin film comprising: a buffer layer formed on said **Si** substrate, where said buffer layer includes an **oxide thin film of zirconium** or of a rare earth element on said Si substrate; and an **electrically conductive thin film** having (100) or (001) orientation on said oxide thin film, a **perovskite oxide thin film** formed on said buffer layer, which is grown epitaxially with respect to said buffer layer, and a ***ferroelectric thin film*** having (100) and (001) orientation, ***which has a different composition than said perovskite oxide thin film and which is epitaxially grown on said perovskite oxide thin film***". The Final Rejection at page 3, lines 9-10, and page 5, lines 10-11, admits that Yano-105 and Yano-647 do not disclose "the ferroelectric film is not the second perovskite thin film that is grown on the second perovskite oxide thin film".

The Final Rejection relies upon Tarui for disclosing forming an epitaxial ferroelectric PZT film on a Pt substrate using a $PbTiO_3$ buffer layer to improve flatness of the ferroelectric PZT film. Final Rejection at page 3, lines 11-13. Tarui discloses:

> The ferroelectric thin film was a c-axis orientation film exhibiting PZT (001) and it had no diffraction pattern other than the diffraction peak from the substrate. Tarui at column 16, lines 28-31.

Because the ferroelectric PZT thin film is epitaxial, the Final Rejection asserts that the $PbTiO_3$ buffer layer underneath the ferroelectric PZT thin film has a (001) orientation. Final Rejection at page 3, lines 15-17; page 5, lines 16-18.

However, because Tarui discloses that the ferroelectric PZT thin film grown on the $PbTiO_3$ buffer layer has only the (001) orientation, the cited prior art fails to suggest the combination of features of independent Claim 1; in particular the limitation of "a ferroelectric thin film having (100) ***and*** (001) orientation" that is epitaxially grown on a perovskite oxide thin film having a different composition.

Because the cited prior art fails to suggest all the limitations of independent Claim 1, the prior art rejections should be withdrawn.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

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